Are We Living in a Robot Cargo Cult?

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ABSTRACT
We use the Cargo Cult metaphor to discuss visions, methods and communication of robot research. Essentially cargo cult involves performing of imitative rituals that are conducted without understanding the underlying cause of a phenomenon. We discuss how this is an ongoing challenge within the field of HRI, and what researchers could do to avoid contributing to a robotic cargo cult.

Categories and Subject Descriptors
I.2.9 [**Computing Methodologies**]: Robotics, K.4.0 [**Computers and Society**]: General

General Terms
Design, Human Factors, Theory

Keywords
Robotic cargo cult, HRI

1. INTRODUCTION
What do we mean with the term *robot* – either as laymen or HRI researchers? Most people can draw a robot, or say something about their idea of what a robot is, what a robot could be used for, and how it could look and behave. This is often inspired by what they have experienced on film, in science fiction literature, children's books, comics, cartoons, toys and other media. Thus, given the cultural foundations and historical concepts of robots, there is a risk that the general ideas of what a robot is and what it will be able to do in a near future is flavoured not so much by current research and existing products as it is of popular culture. This may not only be true for the general public, but also for researchers that may work with unrealistic robot designs.

Reflecting upon existing perspectives of robots should be taken into account in all research on the relationship between humans and robots – when we develop user studies, when we analyse data, when we sketch out scenarios for interaction, and when we design and build new robotic systems. However, we find that the challenges specific to researchers in relation to popular culture have not yet become parts of the mainstream discussions of our field.

Inspired by a metaphor of the "cargo cult", this paper identifies what we see as one of the main challenges for us as researchers working with robotic prototypes, scenarios, and products. We have previously used the cargo cult metaphor to stress the difference between unsound and sound use of prototyping and mock-up techniques in the general field of interaction design [2]. This paper aims to bring this discussion also into the field of HRI, and focus more concretely on the research challenges involved in the design and evaluation of robots at a time when this is interwoven with perspectives of robots inspired by popular culture

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2. THE CARGO CULT METAPHOR
In our earlier work, "cargo cult design" is defined as *"creating a representation without sufficient knowledge of how it actually would work, or presenting the representation while not acknowledging such knowledge"* [2, p. 50].

The most well known description of the cargo cult is found in an episode of the "shockumentary" film Mondo Cane [3]. Here, filmmakers showed how a religious movement of Melanesians, in the beginning of the 20th century would build imitation airplanes, control towers and landing strips in the hope to attract "real" cargo planes. The participants in this cult would reason that the cargo that they had seen arriving on ships and planes had a divine origin, and if they could build exact replicas of the white man's landing tracks, they would receive the same benefits [5].

In 1974 Physicist Richard Feynman, used the term *cargo cult science* to describe a certain type of scientific dishonesty [1]. This referred to when results were presented as "facts" even though they were not proven correctly. Feynman stressed the need for honesty in research and advised scientists to follow two simple principles: to not fool yourself; and to not fool the layman. Similarly, the concept of cargo cults has been used as a metaphor to describe the performing of imitative rituals that are conducted in various design disciplines, for instance in software development [6]. Given the large amounts of depictions, stories and representations of robots in popular media, we see this concept as being of immediate relevance to the area of HRI.

With a *robot cargo cult*, we refer primarily to the ways robots exist in popular culture as a form of mechanical character with imagined functionality based on unknown underlying mechanisms. Here we focus more concretely on possible research challenges with respect to this in the design and evaluation of real robots.

3. IS THERE A CARGO CULT IN HRI?
We believe that society in general, popular culture, researchers and media each contributes to how HRI research progresses. Here we reflect on how what we refer to as a robot cargo cult can be dealt with, discussed, and potentially avoided, in research *visions*, *methods,* and when results are *communicated*.

3.1 Visions

A cargo cult *vision* pushes potentially far out scenarios that appear to be realistic, even if they are not intended to be realised (at least not within the discussed research program). Examples are visions based on assumptions that the future will offer solutions that fit with the visions, though the researchers themselves are not currently able to provide them. As the future trajectory of research is by nature largely unpredictable, such visions may run the risk of reinforcing unrealistic ideas of what robots can do. This is especially as popular media often catch up on such visions, for example reporting how technology at an early research stage will 'soon' inhabit our everyday environments. A concrete example can be found in the 1960's movie 2001, in which the plot was based on real belief among researchers of what future technology would be like. This has been discussed extensively in [7], illustrating how actual technological development can involve a range of unforeseen challenges that force the development into unexpected directions.

In order to perform truly user-centred designs, we need to find ways of addressing these kinds of challenges already at the stage of developing research visions. This does not only involve investigating people's expectations and desires of future robots (likely to be inspired by robots in popular culture), but more importantly to balance these against existing technology and empirical studies of real practices. A second way of addressing this challenge is to include structured reality checks, e.g. to ensure that the visions can be realised with existing resources, instead of relying on "yet to be solved" problems. Naturally, popular culture and far out scenarios can be an important source of inspiration in the development of research visions (e.g in critical design), but the validity and soundness of these will nevertheless need to get validated in real world empirical data.

3.2 Methods

A major challenge when working with complex robotic systems concerns how user studies may be incorporated in iterative design cycles, where prototypes can be sufficiently tested, tuned and taken into realistic use.

As an example, Wizard of Oz [4] is a common method developed in HCI and where the basic principle is to let the computerised part of the system be manually performed by a person (often from a separate control room). In order to test a variety of interactive features before they are fully implemented, this method can save time, effort and resources in finding the most successful path for future development. Because of the complexities commonly involved in realising robotic interfaces, this method has become an increasingly popular method for evaluation within HRI.

A danger that has been noted with this and related methods is that users (and even researchers) may get lured to believe that the step to take from a Wizard of Oz setup to achieve a fully autonomous version of the system is much smaller than is the actual case. This is especially relevant in research that does not intend to end up in a working system, but serve other important purposes, e.g. to learn about how people behave together with embodied interactive artefacts on a more general level. As researchers we must keep in mind that scenarios and corresponding experiences in such cases may be used as food for a robot cargo cult.

3.3 Communication

A third aspect concerns how our results are *communicated*, to media, the general public, to other researchers, as well as to participants in studies. This is also the most typical aspect of a cargo cult as it is described in other papers [1, 2].

This is a serious matter from several perspectives. Firstly, not only the general public, but also researchers may maintain an unrealistic, even fantasy-based, perspective of what robots are and could be, which thus affects the ongoing research. Consequently, both how robots are presented as a cultural phenomenon, as well as among researchers in HRI may sustain and trigger unrealistic visions. As a way of pointing out the challenges of a specific research program, a researcher may for instance describe a future scenario in which a robot must be able to perfectly recognise speech, repair misunderstandings, adapt to the needs of different people, etc. Naturally, within the research community, designing such a robot would involve a tremendous amount of research problems yet to be solved, but for the layman these may appear trivial. Thus, even though the scenario itself does not involve cargo cult communication, there is a risk that it will get used as such once it reaches popular media.

4. DISCUSSION

As robots exist as a strong cultural concept, this also brings along a number of interesting potentials for thought provoking interactive scenarios, services and products. However, we argue that it is our responsibility as researchers to actively work towards sound and realistic ideas that can meet existing or realistic needs, within human-robot interaction. We see this as a matter of research ethics, and with the concept of a robot cargo cult, we hope to initiate a discussion on how to develop methods that explicitly address such issues in future research in our field.

5. ACKNOWLEDGMENTS

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